Report
Of the
Environmental Compatibility Assessment
Workshop IV
Colorado Springs, CO
August 12-13, 1999

Introduction/Highlights

After the welcome and introduction by Neal Nijhawan and a brief review of the prior workshops by Chairman Murray, National Aeronautics and Space Administration (NASA) provided an overall assessment of the current budget situation in NASA and the implications for the Environmental Compatibility Assessment (ECoA) Program. Mike Mann (Associate Administrator for the Office of Aero-Space Technology) emphasized that the Aeronautics technology development budgets have declined by more than one-third in the last two years. These cuts will have significant impacts on the ability of the program to reach its goals for climate change, noise reductions and local air quality. In his remarks he noted that 'the Europeans are taking environmental issues seriously; they will proceed without our help….'

Bob Pearce, NASA Director of the Goals Division discussed the federal investments and what they were designed to accomplish. He mentioned the need to focus on high payoff activities that would not occur without both federal support and the importance of community and industry support in shaping NASA's environmental activities. He stressed the importance of finding win/win situations.

Rich Christiansen, NASA Director of Programs, presented an overview of the environmental programs and the implications of the prospective budget cuts. He noted that the Advanced Subsonic Technology (AST) Program was being phased out; the High-Speed Research (HSR) Program was being terminated. He stressed that these and other potential future budget cuts would have serious impacts on NASA's ability to maintain it's key capabilities and some of the key facilities. He noted that there was not significant noise research after 2002, that vehicle technologies were decimated, and that aviation related research was being virtually eliminated from the Atmospheric Research Program. These actions could have deep impacts on the partnership programs that NASA had with other agencies, industry and the academic community. He observed that it was likely 80% of the work for Ultra Efficient Engine Technology (UEET) Program would be done in-house. In summing up Christiansen observed that critical to the success in formulating the 2001 budget would be support from the public and key constituencies for these programs. That message was currently not reaching the decisions makers and as a result the budgets were being cut.

NASA Programs:

Following the overview presentations NASA presented detailed information on the technical aspects of the programs and projects for noise and emissions noting both the accomplishments and the challenges.

Bill Willshire from NASA Langley provided an overview of the AST Program reviewing the roadmaps, the technology working groups involving customers and partners from industry, academia, Federal Aviation Administration (FAA) and other NASA research centers. Andy Powell provided additional detail on some of the key projects including the noise reduction goals for these projects. The bottom line was that there were no future planned noise reduction programs beyond the AST program, which will end in 2001. This would leave the noise reductions achieved at 5 to 7 dB, which was roughly half of the near term, 10 year, Enterprise goal and far below the 20 dB goal set for 2025.

John Rohde from NASA Glenn presented the road maps and detailed technical information on the emissions programs. He discussed the UEET Program and the revolutionary propolymer technology that could be applicable to future aircraft over a wide range of flight speed. Jim Pittman from NASA Langley discussed the Propulsion Airframe Integration (PAI) Project of the UEET Program. UEET/PAI emphasizes advanced technologies to yield low drag propulsion system installation and the importance of considering the potential noise impacts when evaluating low-drag revolutionary design concepts. Rich Antcliff of NASA Langley provided information on the programs to reduce drag and thereby improve fuel efficiency as a means to address CO_2 reductions. He also covered some of the more revolutionary concepts that were receiving attention, such as smart wing concepts and biomemedics to understand bird flight and its relevance to aircraft.

Frank Aguilera, NASA Ames discussed the Aviation System Capacity (ASC) Program and its elements in response to the NASA Three-Pillar goal to reduce cost and improve the capacity of aircraft and aviation systems. He covered a range of projects, including short haul, civil tilt-rotor aircraft, terminal area productivity and advanced air transport technologies.

Don Anderson, NASA Goddard presented information on the NASA Atmospheric Research Program. This program is designed to provide basic scientific understanding of the impact of supersonic and subsonic aircraft on the troposphere and stratosphere. Included in his presentation was discussion of the models that are under development. A number of these models are being developed with the help and cooperation of the FAA.

The above NASA presentations can be found in the NASA web site. (http://www.aero-space.nasa.gov/library/environ.htm)

Other Agencies:

The FAA, Environmental Protection Agency (EPA) and Department of Energy (DOE) presented information on their programs relevant to the NASA ECoA mission. Howard Wesoky led off these briefings with a discussion of the FAA strategic plan, indicating that computer models that give insight into the system-wide consequences of alternative courses of action are an important FAA Research and Development (R&D) goal. He noted that nearly all of the related FAA noise and emissions models are in need of upgrading but that funding problems have slowed this effort. Records of concerns expressed by the FAA RE&D Advisory Committee about both the NASA and FAA budgets were presented. Finally, he noted that the FAA and NASA generally share a long-term vision for aviation's environmental compatibility, and that ongoing White House and Congressional actions regarding the FY 2000 and 2001 budgets will determine how quickly progress will be made.

Lisa Chang from the EPA noted that despite technology improvements, due to strong growth in demand for air travel, worldwide emissions were expected to increase. She stated that especially in light of this strong growth, EPA and its stakeholders are concerned with the present and growing contribution of aircraft to ground-level ozone and other local air quality problems near airports, and aviation's increasing contribution to the "greenhouse effect" arising from all human activities. She noted that EPA was working with NASA and FAA in a number of interagency and international working groups (such as ICAO and CAEP) to examine all possible solutions to mitigation of aviation's impacts on local and global air pollution concerns. This included technology options such as those developed by NASA, as well as other control approaches such as market based options. She viewed the NASA scientific assessment work, which reduces uncertainties as to aviation's current, and future atmospheric impacts, as well as NASA's technology development work, which produces technological options for mitigation, as critical to global environmental sustainability of this highly important sector.

Jim Ohi from the National Renewable Energy Laboratory (NREL) represented DOE and covered a number of areas where DOE believes effective collaboration between DOE and NASA could occur. Key areas for collaboration include emissions control, fuel cells, advanced energy systems, and carbon management. DOE encouraged NASA and the other federal agencies present to explore potential areas where memoranda of understanding might be developed to further mutual aims of the agencies in developing technologies that further environmental compatibility. In particular he mentioned the areas of fuel efficiency and new technologies using fuels such as hydrogen as key areas of potential collaborative efforts.

Non Federal Organizations:

Bob Cuthbertson from Boeing provided a perspective of the airframe manufacturing industry. He discussed events at Boeing since the last environmental workshop a year ago and illustrated new and derivative airplanes that demonstrate environmental responsibility. He emphasized that Boeing is under much pressure to continue reducing the cost of its airplanes. He reviewed areas where Boeing had participated in the NASA

AST and HSR research Programs to explore ways to reduce noise and emissions (via reduced fuel burn). He noted that the NASA budget cuts would have a negative impact by slowing the pace of technology transfer and reducing the total capability to conduct future research. The future budget scenario driving NASA to request cooperative and collaborative cost sharing will be difficult with different pressures from the company's near-term perspective (cost) and NASA's long-term Three-Pillar vision.

David Fancher from General Electric (GE) provided the perspective of an engine manufacturers. He emphasized the need to reduce the cost of engine ownership to their potential customers. He noted that engine customers are concerned about reducing fuel burn, NOx, noise reduction and other factors that contribute to cost of owning and operating an engine. He expressed his expectation and hope that most of this work would continue under the UEET Program.

John Meier from Allied Signal discussed the views of the small engine manufacturer. He expressed the view that turbofans would likely replace turboprops in business aircraft. He noted that European nations were focussing on air pollution and noise related to ground operations and that more research was needed relative to small engines and auxiliary power units (APUs).

Ian Waitz from MIT gave the view from academia. He posed the question, "How can the limited funding be used more effectively? In addressing this question he emphasized the need for NASA to maintain a broad base for their programs, and avoid the temptation to pull all the work into the NASA laboratories. He noted the importance of the differing perspectives and capabilities of both academia and the industry in cooperative research projects with NASA. He also noted that these sources could be more cost effective in conducting various aspects of the research programs. Waitz also believes that given the increasingly constrained budget environment, NASA needs to focus more strongly on important areas where its contribution is unique, for example longer-term, higher risk technology development, its very significant role in education, and its leadership of the environmental impact assessment efforts. His final point emphasized the need to maintain balance in the NASA program between the engine emissions reducing program and the airframe emissions reducing program.

Krish Ahuja from Georgia Tech offered his views of the NASA situation. He noted that noise research was being particularly hard hit in the budget cutting. He expressed concern that promising research would be abandoned at a critical juncture. He also mentioned that critical expertise would be lost both in academia and industry if more programs were terminated.

Chris Arman from O'Hare International Airport offered his views from the perspective of a major hub airport. He discussed the development of the Advanced Flight Track Procedures underway at O'Hare in an effort to reduce the nighttime noise in residential communities surrounding the airport. He provided an overview of the constrained (slot controlled) operations at O'Hare and the resulting increase in nighttime operations as aircraft seek to meet demands of the flying public. He noted that their recently initiated

World Gateway Program is aimed at adding gates, improving efficiency, enhancing safety, and adding two more FIS locations to meet the air carriers' code-share/alliance needs. He added that monetary outlays in O'Hare's surrounding communities for sound insulation were enormous; $100 million for homes and $120 million for schools for the years 1996 - 1999.

Gary Stowell from San Jose International Airport provided an airport perspective on the technology needed to address the impact of aviation on the environment. He proposed ultimate goals of eliminating the need for restrictions on airports and establishing and maintaining community acceptance for airport operations. He suggested a strategy of achieving a "Net Environmental Gain," when drafting expansion plans. In addition to a community focus on providing for growth by making intelligent land use decisions, and gaining local support, he suggested that NASA could help by focusing on improved aircraft technologies, operational procedures, and air traffic management tools. He also felt that NASA could help by improving noise monitoring systems and analysis software.

Gerald Chambers from American Airlines provided the perspective of a major passenger airline. He stated that there were three major areas of NASA and FAA activities that were of importance to the airlines. These included safety, operating efficiency and aircraft environmental effects, namely, noise and emissions. He gave his opinion that the reductions in NASA budget for environmental research was contrary to the recommendations of the National Science and Technology Council which noted that new technology for aviation was essential to ensuring long term environmental compatibility. He expressed the view that from the airline perspective that many aspects of the HSR, AST, UEET and CNS/ATM Programs were important to the airlines in addressing noise and emissions concerns and improving efficiency. He noted that the airlines had been contributors to the Air Transport Association Emissions Task Force and were also phasing out older aircraft and replacing them with low emission, quieter and more efficient models.

Sue Gander from the Center for Clean Air Policy (CCAP) provided an overview of the emissions problem facing the United States. She observed that 70 million Americans live in areas that exceed the federal ozone standards. She also provided information that showed the projected increase in NOx through 2010. She discussed the range of options to reduce emissions focussing on technology and operational improvements including the implementation of the CNS/ATM system. She also discussed the concept of emissions trading and their application to airlines. She observed that it could provide the incentives that are needed to accelerate the use of more effective technologies for aviation.

Sean Lazenby from the National Organization to Insure a Sound Environment (NOISE) organization discussed the organization/members concerns and the view of NOISE that coordination with the government, customers and communities was essential if we are to achieve workable solutions. He observed that representatives from state and local entities in a number of locations are become more sensitive to these issues and were beginning to advocate policies that would address noise issues. He mentioned that NOISE has adopted

the approach of trying to work with communities, airports and airlines to find workable solutions to the noise problems.

Complete briefings of the above presentations are on the NASA Website at (http://www.aero-space.nasa.gov/library/environ.htm)

Breakout Groups Summary:
This section contains the highlights from the breakout sessions. It will emphasize those areas where there was general agreement of findings or recommendations for action.

There was consensus among the participants that a persuasive argument for the ECoA program has not been effectively communicated to those who make the relevant budget decisions. This was not viewed as solely a NASA problem. It was the opinion of many of the participants that NASA had the responsibility to formulate a needs document. However, the articulation of these needs to important audiences in governments (Federal, state and local), industry, academia and other organizations was viewed as the responsibility of all who had a stake in the success of this program. This was the most consistent message from the participants.

Following on the above message was the recognition that stakeholders need to get involved in educating the public by defining the problem in terms that the public can understand. Observed one of the breakout groups, "…We will not be successful if we simply dump the problem in NASA's lap."

While many participants outside NASA knew that the ECoA budget was under pressure, most did not appreciate the magnitude of the budget cuts or their program implications. This was a wake up call for many of the participants.

Most of the participants expressed the view that a national policy to direct these programs was needed. Some felt that a form of national policy was already in place, citing the NASA Three Pillars Goals or the National Science and Technology Conference report. The critical elements of such a policy or "what it should do" were quite varied and there were many suggestions put on the table. The differing nature of the contents of such a policy suggests that there were a variety of concepts in the minds of the participants as to what a national policy was and what its goals should be.

There were some concerns expressed by a number of participants that the budget pressures facing the program would cause NASA to pull the research back into the NASA system. Many felt that this was undesirable for a number of reasons and urged that such a reaction should be resisted. There was some discussion of the use of the Federal Trust Fund for Aviation for funding NASA environmental research programs, however, no specific recommendations were put forth as to how this might be achieved.

Breakout Groups:
The sections below provide the record of the breakout group discussions. These provide additional details beyond those included in the Summary above.

Report of the Emissions Breakout
ECoA Workshop IV

Methodology: The Emissions Breakout Group met to address the four questions posed by NASA regarding the future of the Environmental Compatibility Program. To facilitate brainstorming and discussion the group was further divided into six smaller subgroups composed of four or five members each. Each of the questions was addressed in order and about 20 minutes was allowed for general discussion of each question by the subgroups. This was followed by a presentation of each sub-group's findings and recommendations. These were then summarized as part of the overall breakout group findings.

Question #1: *Considering your needs, the current NASA Programs and investment strategies, the international situation, and limited budgets, is a national policy/strategy necessary to direct NASA/FAA to have programs for noise, emissions, and atmospheric research to address environmental issues and if so,*

Four of the six subgroups said that a policy/strategy was needed. The other 2 groups were mixed with some for a policy/strategy and some opposed. Some of the groups felt that a national policy already exists.

The discussion among the subgroups revealed that there was some difference of opinion as to what a national policy was. The view was raised by some that the NASA Three Pillars Goals constituted an existing policy. Others believed that a national policy had to be established by the Administration or the Congress.

a. What should be the critical elements of that Policy?
A compilation of the responses to the question included the following:
1) There should be a balance of stakeholder needs and the policy should assure that benefits accrue to the stakeholders and communities. The interested parties (stakeholders) should have collective ownership of the policy.
2) The policy should be needs driven and some of the subgroups expressed the opinion that the federal government must establish the need.
3) The policy should confront the corporate welfare issue, and the aviation industry should be able to benefit from the research program. Some form of cost sharing should be included. (A sliding scale was proposed whereby government would perform most of the research in the early phases and then shift to industry toward the commercial deployment/product phase (After Technology Readiness Level (TRL)-6). There was no challenge to such an approach in the discussions.)
4) Several suggestions were made regarding the nature and focus of the program. Broad guidance for the NASA program included suggestions that it have a

long term, research focus and, conversely, that it include both near term and long term projects. (There was no consensus reached, nor given the time available was there any in-depth discussion of the merits of either position.)

5) It was recommended that the environmental problems be viewed in the global political context.

6) Specific topics were mentioned for inclusion in the policy. These included--work on emissions of CO_2, low-altitude NOx and an emphasis on systems solutions.

b. What are the pros and cons to having such a policy?

The participants identified a number of benefits that might accrue from having a national policy among theses were the following:

1) Focus the efforts of the participants and stakeholders toward achieving common goals;

2) Further public awareness of the issues and needs and provide a national voice;

3) Coordinate agency activities, and

4) Facilitate efforts to increase funding to address these problems.

The subgroups identified several potential problems that such a policy might create:

1) Create another layer of bureaucracy and add to cost and overhead;

2) Blend agency missions and blur the lines and responsibilities between NASA and FAA and EPA, etc. (The research role of NASA and the regulatory roles of FAA and EPA were noted.)

3) Could result in NASA losing control of its program, and

4) It could impact other NASA goals in terms of budgets or management attention.

5) It could be subject to political leverage and manipulation with changing administrations or congressional leadership.

6)

c. How can we achieve this (national policy)?

A number of suggestions were offered by the subgroups--

1) Form a steering committee of key stakeholders to define the national policy;

2) Forcefully make the case (the need for the program) to garner public support;

3) Identify and solicit the help of congressional champions, and

4) Create a forum for the effected stakeholders.

Question #2--*From near and far-term perspectives, what are the appropriate roles in developing mitigating technologies for NASA, FAA, US industry and other organizations?*

a. Given the current budget situation:

NASA's Role--There were differing views among the subgroups as to what NASA's role should be in technology development. Some believed that NASA should focus on pre-competitive technology development to help avoid duplication of expenditures in the early stages of research and development. Conversely, other subgroups believed they should move technology development through TRL-6 (Beyond the current policy of stopping at TRL 3 or 4) and play a bigger role in the transition of

technologies. (Industry's role would start after TRL 4 in one case or TRL 6 in the other.)

There were also different opinions on the time perspective of the NASA's research role. Some groups felt it should focus on long term RD&T, while others were of the opinion that more attention had to be given to near-term payoff and impacts. (It is interesting to note that there was no specific mention of the Atmospheric Research Program.)

Reviewing concepts was put forward as an important role for NASA's environmental research program.

FAA's Role—The role of FAA in technology development was couched in terms of its regulatory mission and its responsibilities for the CNS/ATM program. The research role of FAA for CNS/ATM should shift to NASA as the system approached deployment.

Other Agencies—There was some discussion on the research roles of other agencies. It was felt that other agencies could provide funds or "in kind" contributions to mutually beneficial research. There was the plea for more synergy among the agency research efforts.

Industry—Funding and responsibility for technology development was viewed as a shifting role whereby industry would assume more responsibility as a project moved from basic research toward technology development and eventually commercialization. Again the sliding scale concept was put forth as a model.

b. *Given further budget cuts:*
   With the prospect of further budget cuts the view was put forth that NASA should concentrate on long term research. Others expressed concern that these cuts have lead to a situation where 80% of the work is being done inside NASA and only 20% goes outside to academia and industry. Many felt that such an arrangement would be an unhealthy situation for the program. They expressed the view that more synergy and cross-fertilization was essential in the budget cut scenario. Another point raised was that research in academia would be less costly.

   One subgroup felt that it was impossible to make an intelligent assessment without considerably more data and study.

   There was the general view that industry would be called upon to assume an even greater share of the research and technology development effort if further budget cuts were imposed on the NASA environmental program. Under such a scenario there would be an even greater emphasis on short-term research.

Question #3: *Are current environmental programs of industry and agencies (NASA, EPA, FAA, etc.) adequate and rightly paced to meet National and International environmental needs? If they are not…*

The general opinion was that the current (As stated in the 2000 budget) NASA environmental programs are not adequate, more specifically, that the environmental mitigation programs for aviation were not adequate. The pace of development of solutions was viewed as moving much too slowly. The comment was made that 'the states need for NOx relief in less than 10 years' was one example of this problem.

This example lead to some discussion regarding the pace of EPA regulations. One participant noted that 'the pace of all development in the environmental area was moving too slow, and that the only thing that was moving too fast was the pace at which regulations were being put in place. This lead to a spirited debate regarding the pace of regulations versus the speed with which new technology is introduced in the field of aviation. A variety of views and interpretations of the statement were put forth without any clear resolution.

a. What Changes should be made?
A number of suggestions were made by the subgroups:
1) Provide more funds to NASA (the National Aviation Fund with its $6.8billion surplus should be considered as a source for such funding);
2) Invest more funds and effort in assessment/impacts and metrics;
3) NASA must deliver the message more effectively and there needs to be stronger advocacy by the stakeholders with a more consistent message to emphasize the importance of this problem;
4) Need to change policy to drive technology, not technology to change policy;
5) NASA needs to re-evaluate its goals and roles (the current goals are not being met);
6) Heighten FAA's role (FAA response was that added funding was very unlikely), and
7) Refine and articulate the measures of success.

b. If NASA is unable to pursue its proposed environmental programs, what are the impacts on your plans?
There was some discussion as to the meaning of this question. After some discussion it was agreed that the question was not well defined. Three general points surfaced from the subgroup discussions;
1) Aircraft costs are likely to increase and aviation will not meet their environmental goals because technology based environmental improvements will take place more slowly than anticipated.
2) There is a risk of putting the U. S. aviation industry at a competitive disadvantage in international competition.
3) The nation runs the risk of severely weakening its scientific and technical infrastructure in terms of scientific and technical talent and world class facilities thus risking the loss of our 'scientific critical mass'.

4) High tech boundaries would not be pushed and the resulting economic payoffs would not occur.

Question #4: *What is the right approach to achieve a win/win situation of operational benefit and environmental improvements?*
Each of the subgroups drafted a response to this question. There were common themes that ran through these responses. In addition there were a number of specific suggestions that varied from subgroup to subgroup. The broad themes included the following:
1) NASA has not communicated the need for this program effectively. There was widespread agreement that the message, 'the Need for the Program,' was not effectively articulated in the appropriate forums (I.e., Congress). This was the most consistent message from the emissions breakout group. There was no one in the group who felt that the needs were being effectively communicated. Several subgroups compared this need to communicate this message to a "marketing plan". It was suggested that the hiring of a business plan professional could be helpful.
2) A number of key points that should be included in the "needs message" were identified. Such as, make the need a national priority similar to the Apollo Program, or emphasize the idea of "pay now or pay later" with emphasis that the pay later price might be very expensive.
3) Stakeholders need to be involved in a public education process to define the problem in terms that the general public could understand. It was noted by one subgroup 'we will not achieve success if we simply dump the public education task in NASA's lap'. This education process should be built upon sound analysis of the impact of failure to attain the NASA environmental aviation goals.

Other specific needs included—
1) Protection of the scientific and technical infrastructure of people and facilities;
2) Presence of strong leadership and vision;
3) Establishment of clear, long term regulatory goals, so that industry can plan accordingly;
4) Importance of a technology lead in this area, and
5) Collectively we need to articulate that there are generic competitive reasons why industry is focussed on the short run, plus the proprietary nature of their research; this means that NASA is needed to fulfill the long-term research and development needs.

Report of the
Noise Breakout Group

Ray Brown convened the noise breakout group by stating that he would encourage open discussion of all the questions posed in the agenda and other items that would come up in these discussions. He stated that the group would break for lunch at 12:30 and he and Rod Jago would develop the noise briefing for the plenary session, which would start at 1:30. Following these Introductory remarks the Noise Breakout group addressed the first question.

Question #1: *Considering your needs, the current NASA Programs and investment strategies, the international situation, and limited budgets, is a national policy/strategy necessary to direct NASA/FAA to have programs for noise, emissions, and atmospheric research to address environmental issues and if so,*

a. What should be the critical elements of that policy?
b. What are the pros and cons to having such a policy? and,
c. How do we collectively achieve it?

After considerable discussion on the intent of this first question, the group decided that, yes a policy is needed to direct that NASA/FAA have programs for noise, emissions, and where appropriate, atmospheric research to address environmental issues.

The following major points were recommended to be briefed at the plenary session.
     1. Current policies should be considered when formulating the national policy.
     2. An education/communication effort should be conducted in an attempt to communicate that the NASA noise program would be going away unless additional funding was provided in the near term.
     3. Continuation of NASA, Industry, and Academic expertise needed to be ensured. This included the necessary facilities to perform the required research and development.
     4. Long term research and development on noise issues needed to be funded at the appropriate level to conduct a viable program.

Question #2: *From near and far-term perspectives, what are the appropriate roles in developing mitigating technologies for NASA, FAA, US industry and other organizations?*
a. Given the current budget situation:
b. Given further budget cuts:

The response was that the group would address the 'roles' question but not tie it to the sub-bullets, which considered the current budget limitations and the potential that NASA might lose more funding. The following represents the points made at the plenary session.

Appropriate Roles for:

NASA should change its internal priorities and get back into the long-term research mode in the noise area. If no additional funding is provided then NASA should take a minimal role on noise research with the subsequent impact of no long-term noise improvements being achieved nationally. This latter point was completely unacceptable to all entities in the group.

FAA's efforts should continue to be focussed on sound insulation efforts, certification and modeling. The point was made that currently the FAA is concentrating on insulation with no emphasis on updating noise models.
(Note: In response to a request for information on the funding for the 'insulation program,' the FAA provided the following information:

The total amount of Airport Improvement Program (AIP) funds issued for soundproofing for each of the past three years has been:
    FY 96 $70,671,716
    FY 97 $63,064,626
    FY 98 $80,406,135

Industry should continue focussing on short-term research. The point made on his item was that industry has to focus on the market place and profits in order to stay in business and can ill afford to apply their revenues towards long-term research efforts.

All other entities need to focus their efforts by communicating their concerns on the current state of affairs and the resulting consequences if the above recommendations are not implemented. A point was made that academia should continue providing expertise to governmental agencies on
noise issues.

Question #3: *Are current environmental programs of industry and agencies (NASA, EPA, FAA, etc.) adequate and rightly paced to meet National and International environmental needs? If they are not…*

The Group response to the third question which asked whether environmental programs, particularly NASA's, are adequate and rightly paced to meet National and International needs, was a resounding NO.

a. What changes should be made?
The group responded that increased funding was required and that NASA should have a focussed noise program.

b. If NASA were unable to pursue its proposed environmental programs, how would it impact your plans?

The group responded that additional airports would have constrained operations, technical leadership would be lost and the US would lose its competitive edge. Additionally, there would be no plan for improvements in aircraft noise and core competencies and facilities would be lost.

Question #4: *What is the right approach to achieve a win/win situation of operational benefit and environmental improvements?*
The group determined that:
> 1. Improving the noise situation is a shared responsibility of all stakeholders. (This answer relates back to the Roles responses.)
> 2. It was recommended that a team be established to develop a noise strategy. Included in this group's charter would be to determine priorities, communicate concerns and identify a spokesperson/advocate to get the message to those who can help rectify this degrading situation.
> 3. The final point made was that the US needs to adequately invest in noise research and development efforts in order to achieve a win/win situation.

A final item discussed in this group and presented to the plenary session were some recommended action items for the noise group. These included:
> 1. Key charts from the presentations would be gathered before the attendees left the workshop. These would be helpful in communicating the criticality of the situation to higher ups within each person's organization.
>
> 2. All presentations would be placed on the NASA website within 1 week. Presenters were reminded that this could only be accomplished if they provided the presentations to SAIC by Monday following the workshop.
>
> 3. The attendance roster should be distributed by e-mail by Monday following the workshop.

4. Noise group members were asked to file trip reports within 1 week so that management would get a picture of the current situation.

5. The FAA representative was asked to provide a dollar amount for how much the FAA spends on insulating houses and schools around airports. A 1-week response was requested.
6. NASA was asked to proved data on the resource impacts, dollars, people, and facilities, if funding was not increased. This was also a 1-week task.

7. Finally, Ben Sharp was asked to provide a description of a constrained capacity transportation system so that participants and others could see the potential consequences of a do nothing approach. Ben was asked to provide this data in 1 week if possible.

Ray Brown thanked all participants of the noise group for their honest and open dialogue. His final words were that he thought this workshop was extremely beneficial to all concerned and he hoped that the recommendations coming from the two breakout groups would have a positive influence on establishing meaningful environmental programs for the governmental agencies involved. He noted that from his perspective we need to keep going forward on this effort.

Appendices:
  A. Agenda for Workshop #4
  B.   List of Attendees

Appendix A
NASA Environmental Compatibility
Workshop IV (August 12-13, 1999)

Agenda

Day 1

8:00 *Welcome* (Neal Nijhawan)

8:15 - 8:30 *Workshop Objectives* (Michael Mann)

8:30 - 9:00 *Review Previous Workshops* (Frank Murray)

9:00 –9:30 *NASA Overview* (Robert Pearce)

9:30 – 10:00 *NASA Programs Overview* (Richard Christiansen)

10:00 Break

10:15 – 12:15 *NASA Environmental Programs*
  a. *Noise*
    1) *Current* (Andy Powell)
    2) *Planned* (Bill Willshire)

  b. *Emissions*
    1) *Current* (John Rohde & Richard Antcliff)
    2) *Planned* (John Rohde & James Pittman)

12:15 – 1:15 Lunch

1:15 – 2:00 *Related Programs*
  a. *Aviation Systems Capacity* (Frank Aguilera)
  b. *Atmospheric Research* (Don Anderson)

2:00-3:00 *Other Agencies' Related Research Programs & Coordination with NASA*
  a. *FAA* (Howard Wesoky)
  b. *EPA* (Lisa Chang)
  c. *DOE* (Jim Ohi)

3:00-3:15 Break

3:15-4:45 *Customer Perspective and Other Research*
  a. *Airframers* (Boeing-Robert Cuthbertson)

  b. *Engine Manufacturers*
    (1) *General Electric* (David Fancher)
    (2) *AlliedSignal* (John Meier)

Academia
    (1) *Emissions* (Ian Waitz)
    (2) *Noise* (Krish Ahuja)

4:45 – 5:15   *Customer Perspectives*
       a. Airports
           (1) *Chicago O'Hare* (Chris Arman)
           (2) *San Jose* (Gary Stowell)

Day 2

8:00-9:00   *Customer Perspectives* (Continued)

       b. Airlines (American Airlines-Jerry Chambers)

       c. NGO
           (1) *Center for Clean Air Policy* (Sue Gander)
           (2) *NOISE* (Sean Lazenby)

       Breakout Session Guidance (Frank Murray)

9:00   Break

9:15 – 12:30   *Convene Breakout Groups (Noise Group & Emissions Group)*
            Breakout to Clarify Information & Discuss the Following Questions

1. Considering your needs, the current NASA Programs and investment strategies, the international situation, and limited budgets, is a national policy/strategy necessary to direct NASA/FAA to have programs for noise, emissions, and atmospheric research to address environmental issues and if so,

- What should be the critical elements of that policy?
- What are the pros and cons to having such a policy?
- How do we collectively achieve it?

2. From near and far-term perspectives, what are the appropriate roles in developing mitigating technologies for NASA, FAA, US Industry and other organizations,

-       Given the current budget situation,
-       In the event NASA loses more funding

3. Are current environmental programs of Industry and agencies (NASA, EPA, FAA, etc.) adequate and rightly paced to meet National and International environmental needs? If they are not,
    - What changes should be made?
    - If NASA is unable to pursue its proposed environmental programs, what are the impacts on your plans?

4. What is the right approach to achieve a win/win situation of operational benefit and environmental improvement?

12:30   Lunch

1:30-2:15   *Reconvene Breakout Groups (Prepare Plenary Report)*

2:15 – 3:00 *Plenary: Report back from Breakout Groups and Discussion*

3:00   *Next Steps/Closing Remarks* (Neal Nijhawan & Frank Murray*)*

Appendix B

Last Name	First Name	Company
Aguilera	Frank	NASA Ames
Ahuja	Krish	Georgia Institute of Technology
Anderson	Don	NASA Goddard
Antcliff	Rich	NASA Langley
Arman	Chris	City of Chicago/O'Hare Airport
Armstrong	Jeff	AlliedSignal
Barker	Nigel	BFGoodrich
Beltran	Luis	NASA Glenn
Brines	Gerald	Allison Engines
Brown	Ray	Delta Airlines
Chambers	Jerry	American Airlines
Chang	Lisa	EPA
Christiansen	Rich	NASA HQ
Clarke	John-Paul	MIT
Costa-Fisher	Therese	CALSTART
Cuthbertson	Bob	Boeing
Davis	Tom	NASA Ames
Desrosier	Walter	GAMA
Dillon	Barbara	SAIC
Dodds	Will	GE Aircraft Engines
Dollyhigh	Sam	NASA Langley
Dudley	Michael	NASA Ames
Dwoyer	Doug	NASA Langley
Fancher	Dave	GE Aircraft Engines
Galbraith	Don	Galbraith Associates
Gander	Sue	Center for Clean Air Policy
Gantt	Jarvis	Univ. of TX-Applied Research Lab.
Gliebe	Philip	GE Aircraft Engines
Graham	Jack	LA Int'l Airport
Harbour	Shana	ICF Consulting
Hart	Peter	Allison Engine
Hartmann	Tom	Lockheed Martin Skunkworks
Howard	Bob	AEDC/Sverdrup
Howell	Aubre	Northrop Grumman
Isaacson	David	NASA Ames
Jacobson	Lynae	SEATAC Airport
Jaekel	Robert	Pratt & Whitney
Jago	Rod	SAIC
Keller	Jay	Sandia
Lawrence	Rich	NASA Goddard
Lazenby	Sean	NOISE
Le	Duc	US DOE
Lee	Chi-Ming	NASA Glenn
Liang	Diana	FAA

Mann	Mike	NASA HQ
Manning	Bryan	EPA
Mathews	Doug	Pratt & Whitney
Meier	John	AlliedSignal Aerospace
Mercure	Robert	NASA HQ
Miake-Lye	Richard	Aerodyne Research Inc.
Miller	Nicholas	HMMH
Moran	Stephen	White House/OSTP
Murray	Frank	SAIC
Nangia	Vinod	AlliedSignal Aerospace
Nijhawan	Neal	NASA HQ
Ohi	Jim	NREL
Owens	Robert	Pratt & Whitney
Parente	Charlie	Northrop Grumman
Pearce	Bob	NASA HQ
Pehrson	John	Camp Dresser & McKee Inc.
Pittman	Jim	NASA Langley
Powell	Clemans	NASA Langley
Puglia	Guy	Continental Airlines
Ray	Ron	NASA Dryden
Reuss	Lisa	SAIC
Rohde	John	NASA Glenn
Rosfjord	Tom	United Technologies Research Center
Schein	David	Northrop Grumman
Segalman	Irwin	Pratt & Whitney
Sehra	Arun	NASA Glenn
Senick	Paul	NASA Glenn
Sepulveda	Dom	Pratt & Whitney
Sharp	Ben	Wyle Laboratories
Shivashankara	Belur	Boeing
Smith	Reid	Pratt & Whitney
Soderman	Paul	NASA Ames
Stowell	Gary	San Jose International Airport
Sutkus	Don	Boeing
Tacina	Robert	NASA Glenn
Waitz	Ian	Massachusetts Institute of Technology
Weir	Don	AlliedSignal Aerospace
Wesoky	Howard	FAA
Wey	Chowen Chou	NASA Glenn
Willshire	Bill	NASA Langley
Woosley	Ted	Landrum & Brown
Yu	Jia	BFGoodrich Aerospace